

Scientific Computing Workshop – Testing projectile motion

Remember that there are 3 areas that go into research: theory, computing, and experiment. We've dabbled in the first 2, and now we can see how our theories and codes compare to real life.

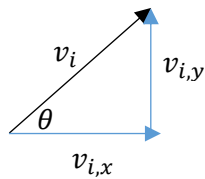
Projectile Motion equations:

$$\begin{aligned}v_{f,y} &= v_{i,y} - g\Delta t & v_{f,x} &= v_{i,x} \\ y_f &= y_i + v_{i,y}\Delta t - \frac{1}{2}g\Delta t^2 & x_f &= x_i + v_{i,x}\Delta t\end{aligned}$$

Where $\Delta t = t_f - t_i$, $g = 9.81\text{m/s}^2$, and we assume that there is no acceleration in the x direction.

Our experiment is shooting small projectiles out of an air cannon. The air cannon can tell us the angle at which it is positioned from the horizontal (θ) and the total initial velocity of the projectile (v_i). How can we use this information to come up with a reliable experiment? What is realistic to measure?

Useful figures and equations:



$$\sin\theta = \frac{v_{i,y}}{v_i}, \quad \cos\theta = \frac{v_{i,x}}{v_i}, \quad \tan\theta = \frac{v_{i,y}}{v_{i,x}}$$

How accurate do you think the experiment is?

What are some of the sources of error?

What assumptions did we make that might not be true?

How could we improve the experiment, within realistic means?